Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 15 (2011) 1889 – 1893

Procedia Engineering

www.elsevier.com/locate/procedia

Advanced in Control Engineering and Information Science

Study on Risk Evaluation of Enterprise Information Systems

Chaogai Xue[a] a*, Junjuan Liu[a], Haiwang Cao[b]

[a]*Department of Management Engineering, Zhengzhou University, Zhengzhou, Henan, 450001, China*
[b]*Department of Electronic and Communication Engineering, Zhengzhou Institute of Aeronautical Industry Management, Zhengzhou, Henan, 450015, China*

Abstract

In order to evaluate enterprise information systems' risk quantitatively, a new method for risk evaluation is studied. Firstly, a set of evaluation system is proposed for enterprise information systems. Secondly, the evaluation model is built and the corresponding algorithm, i.e., Refining High indexes (RHI) algorithm, is given. Finally, the application of the evaluation system, the evaluation model and RHI algorithm is explained through an example, which provides quantitative references for enterprise information systems' risk evaluation.

Selection and/or peer-review under responsibility of [CEIS 2011]
Keywords: Risk evaluation; Enterprise information systems; Refining High indexes algorithm

1. Introduction

With the development of information technology, the market competition is increasingly intense and the uncertainty of environment has increased. The risk evaluation of enterprise information system(EIS) plays an increasingly important role. At present, the studies about risk of enterprises information systems include risk management [1], risk factors analysis [2], risk evaluation [3-4] etc, in which the methods of enterprise information systems' risk evaluation involve risk matrix, AHP-based method, fuzzy comprehensive evaluation, method based on probability and statistics etc. For example, reference [3] proposed the multi-level integrated assessment model which evaluated software projects' risk. Overall,

* Corresponding author. Tel.: +0-086-371-67780985
E-mail address: caohaiwang@zzia.edu.cn.

doi:10.1016/j.proeng.2011.08.352

these researches has laid foundation for the risk management in some degree, but most of them are qualitative analysis and do not form a complete index system. Thus, a set of evaluation system is proposed for enterprise information systems in this paper. Then the evaluation model is built and the risk is evaluated by the method of layer analysis, which provides quantitative references for reducing enterprise information systems' risk.

2. Risk assessment index system

Enterprises' risk identification can be divided into the following three stages: primary preparation, project implementation and post evaluating. The evaluation index system is given, as shown in Figure 1.

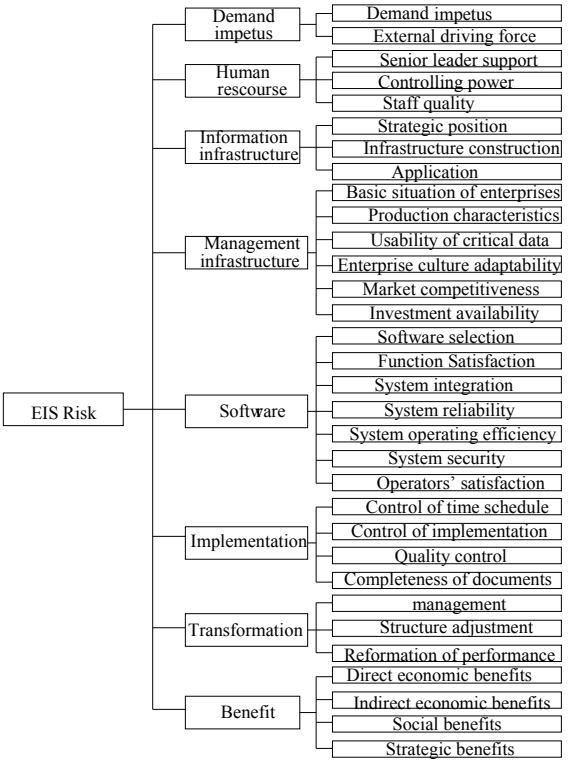

Figure 1 Risk Index System of EIS

3. Evaluation of EIS Risk

3.1 Evaluation model

A new assessment model for enterprise information systems' risk is built according to the proposed evaluation index system. The major components is given, as shown in Figure 2.

The demand impetus risk of EIS is analyzed to show the composition of this model.

(1) A: It is posed by the index level. The demand impetus of business management and driving force of external environment are included.

(2) B: It is posed by the refining index of each index level.

(3) C: It is posed by the relation matrix between each index level and its refining index, standard values of each refining index, and actual value of the enterprise.
(4) D: It is posed by the importance of the criterion level index which corresponding to the index level, degree of risk, and risk index.

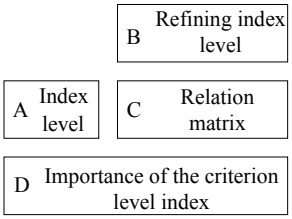

Figure 2 Evaluation model of Risk

3.2 Evaluation algorithm

A new algorithm, Refining High Indexes (RHI) algorithm is proposed based on the established risk evaluation index system and evaluation model. The specific steps are as follows:

Algorithm 1: RHI Algorithm

Step 1: Building A. Assuming that the importance of index which corresponding with each index level are described by the following five levels (that is, 1,2,3,4,5, and from 1 to 5, the importance is increasing):

Step 2: Building B. It is mainly posed by the refining index of each index level.

Step 3: Building C.Assuming the degree of relationship between each index level and each refining index $r_{ij}\left(i=1,2,\cdots,m;\ j=1,2,\cdots,n\right)$ are described by the following six levels(that is, 0,1,3,5,7,9, and from 0 to 9, the relationship between the index level and refining index is increasing).

Step 4: Defining the relationship between refining indexes. (The evaluation indexes of same level are mutually independent.)

Step 5: Calculating the importance score h_j and importance h_j' of each refining index.The importance score and importance of each refining index are calculated as follows：

$$h_j=\sum_{i=1}^{m}k_i r_{ij}\quad\left(j=1,2,\cdots,n\right)\qquad\qquad h_j'=\frac{h_j}{\sum_{j=1}^{n}h_j}\quad\left(j=1,2,\cdots,n\right)$$

Step 6: Acquiring the degree of each refining index w_j. The degree of each refining index $w_j\left(j=1,2,\cdots,n\right)$ is measured by the ratio of the gap between index value of current risk and standard value to standard value.

$$w_j=\frac{\text{gap}}{\text{standard value}}\times 100\%$$

Step 7: Calculating the risk index R_j of each refining index. The risk index of each refining index is calculated as follow:

$$R_j=\sum_{j=1}^{n}w_j h_j'$$

Step 8: Calculating the risk value of criterion level index（Weighted Average Risk Value, labeled as $WARV$）.

$$WARV = \sum_{j=1}^{n} R_j$$

Step 9: After calculating the risk index of each criterion level index, goto step 1. The final risk index of enterprise information system can be obtained.

In addition, those indexes that haven't yet fully quantitative are evaluated by the A, B, C, D, E five levels. Where, A—is very satisfied with the conditions; B—is satisfied with the conditions; C—is more satisfied with the conditions; D—is general satisfied with the conditions; E—is not satisfied with the conditions.

4. Example

According to the risk evaluation model, and the risk index of an enterprise information system is evaluated by RHI algorithm.The demand impetus risk is analyzed to explain the calculation of criterion level index.

			Urgency of enterprise to improve management level	Plumpness of manager workload	Urgency of business process reengineering	Successful proportion of enterprises archrival	Information contention	Market concerned degree of industry	Urgency of government policy	Stability of policy
Demand impetus		5	7	5	9					
External driving force		1	35	25	45	7	9	5	3	1
Importance score						7	9	5	3	1
Standard index			External urgent A	120%	External urgent A	80%	External high A	General concern C	Higher B	General stable C
Current enterprise index			B	100%	A	50%	B	C	C	C
Calculating result	Degree of importance		0.27	0.19		0.05	0.07			
	Degree of risk		1/5	1/6	0	3/8	1/5	0	0	0
	Risk index		0.054	0.032	0	0.020	0.014	0	0	0
Total: The risk index of demand impetus is 0.120										

Figure 3 Risk of Enterprise Information System

Similarly, the other index values of the criterion level can be obtained. The results are as follows:

Table 1 Risk index value of criterion level

Index	Demand impetus	Human resources	Information infrastructure	Management infrastructure	Software	Implementation	Transformation	Benefit
Risk value	0.120	0.160	0.260	0.203	0.125	0.177	0.154	0.124

According to the risk index values of the criterion level, the risk index of this enterprise information system can be obtained, as shown in Figure 4.

	Demand impetus risk	Human resources risk	Risk of information infrastructure	Risk of management infrastructure	Software risk	Implementation risk	Transformation risk	Benefit risk
Risk of enterprise information system	5	7	3	3	7	9	5	7
Degree of importance	0.109	0.152	0.065	0.065	0.152	0.196	0.109	0.152
Degree of risk	0.120	0.16	0.260	0.203	0.125	0.177	0.154	0.124
Risk index	0.013	0.024	0.017	0.013	0.019	0.035	0.017	0.019
Total: The risk index of enterprise information system is 0.157								

Figure 4 Risk Evaluation of Enterprise Information System

According to the refinement by layer and evaluation, the risk index of this enterprise information system is calculated to be 0.157. It means that the failure probability of this enterprise to construct the information system is 15.7%. And the risk index of implementing risk is the highest according to Figure 4. So the enterprise should take measures actively to avoid the risk during the construction.

5. Conclusion

The rapid development of information technology means both opportunities and challenges to enterprises. And how to reduce the risk becomes the arduous task faced by enterprises. Combining with the process implementation phase, a set of evaluation index system for enterprise information systems' risk is proposed based on the risk analysis. Then according to the proposed RHI algorithm, the risk evaluation of enterprise information system is implemented. And then the risk evaluation is explained by a case study. This study enriches the risk theory of enterprise information systems, and lays the theoretical basis for reducing the enterprise risk.

Acknowledgements

This work is supported by National Natural Science Foundation of China Grant #70971119, #70901066, #70701031.

References

[1] Zheng Shu-Yan: Risk Management of Enterprise Management Information System in Project Implementation. Chinese Accounting Computerization.pp. 30-32, (2004).
[2] Zhu Huai-Yi, Chen Wei-Xiang and Li Yi-Na: Analysis of Risk Factors and Research of Risk Precaution Measures about the Life Period of Management System. Science of Science and Management of S. &. Vol.24, pp.21-24,(2003).
[3] Zhang Luo-Ling and Li Shi-Xian: The Integrated Risk Evaluation Model for the MIS Project. Computer Science.Vol.30,pp.150-153,(2003)
[4] Zhu Yan and Yang Yong-Tian: Research on Information Security Evaluation Model Based on Hierarchy Structure. Computer Engineering and Application.Vol.40, pp.40-43,(2004).